WHAT IS CLAIMED IS:

1. A method of obtaining an ultrasound perfusion image of tissues perfused with blood containing microbubbles, the method comprising:

transmitting at least one broad beam of microbubble-destroying ultrasound into the tissues, each beam of microbubble-destroying ultrasound encompassing a first area of the tissues, the microbubble-destroying ultrasound having an intensity that is sufficient to destroy microbubbles in the tissues that are insonified by the microbubble-destroying ultrasound;

repetitively transmitting a plurality of beams of imaging ultrasound into the tissues, each beam of imaging ultrasound having a second area that is smaller than the first area, the imaging ultrasound having an intensity that is substantially insufficient to destroy microbubbles in the tissues that are insonified by the imaging ultrasound;

receiving reflections from each of the transmitted imaging ultrasound beams in respective receive beams, each of the receive beams having a third area that is smaller than the first area; and

processing the received reflections over a sufficient period to allow re-perfusion of the tissues to provide an ultrasound perfusion image.

2. The method of claim 1 wherein the act of transmitting at least one beam of microbubble-destroying ultrasound into the tissues comprises sequentially transmitting a plurality of beams of microbubble-destroying ultrasound into the tissues.

3. The method of claim 2 wherein the act of sequentially transmitting a plurality of beams of microbubble-destroying ultrasound into the tissues comprises sequentially transmitting the beams of microbubble-destroying ultrasound at a rate that is sufficiently high that subsequent beams are transmitted before a previously transmitted beam of microbubble-destroying ultrasound has been fully reflected from the tissues.

4. The method of claim 1 wherein the act of transmitting at least one beam of microbubble-destroying ultrasound into the tissues comprises transmitting a single beam of microbubble-destroying ultrasound into the tissues.

5. The method of claim 1 wherein the act of transmitting at least one beam of microbubble-destroying ultrasound into the tissues comprises transmitting at least one focused beam of microbubble-destroying ultrasound into the tissues.

6. The method of claim 1 wherein the act of transmitting at least one beam of microbubble-destroying ultrasound into the tissues comprises transmitting at least one plane-wave beam of microbubble-destroying ultrasound into the tissues.

7. The method of claim 1 wherein the act of repetitively transmitting a plurality of beams of imaging ultrasound into the tissues and receiving reflections from each of the transmitted imaging ultrasound beams comprises transmitting the beams of imaging ultrasound into the tissues at a first frequency and receiving reflections from the transmitted imaging ultrasound beams at a second frequency that is a harmonic of the first frequency.

8. The method of claim 1 wherein the size of each second area insonified by a respective transmitted imaging beams is substantially equal to the size of the respective third area from which reflections from each of the transmitted imaging ultrasound beams are received.

9. The method of claim 1, wherein transmitting at least one broad beam of microbubble-destroying ultrasound further comprises setting at least one of the transmission parameters of beam focus, transmit aperture, or transmit apodization in correspondence with a desired first area size.

10. The method of claim 1, wherein transmitting at least one broad beam of microbubble-destroying ultrasound further comprises transmitting a plurality of broad beams through volumetric regions in different angular directions.

11. A method of obtaining an ultrasound perfusion image of tissues perfused with blood containing microbubbles, the method comprising:

using ultrasound to simultaneously destroy substantially all of the microbubbles in the tissues over a first area; and

repetitively using ultrasound transmitted and received in a plurality of second areas that substantially encompasses the first area to obtain an indication of the quantity of microbubbles in the tissues that are intact over a re-perfusion time, each of the second areas being smaller than the first area.

12. The method of claim 11 wherein the act of using ultrasound to simultaneously destroy substantially all of the microbubbles in the tissues over a first area comprises using a broad beam of ultrasound to simultaneously destroy substantially all of the microbubbles in the tissues over the first area.

13. The method of claim 11 wherein the act of using ultrasound to simultaneously destroy substantially all of the microbubbles in the tissues over a first area comprises using a plane-wave beam of ultrasound to simultaneously destroy substantially all of the microbubbles in the tissues over the first area.

14. The method of claim 11 wherein the act of using ultrasound to simultaneously destroy substantially all of the microbubbles in the tissues over a first area comprises using a plurality of sequentially generated ultrasound beams without subsequent echo reception to destroy all of the microbubbles in the tissues over a plurality of first areas.

15. An ultrasound imaging system, comprising:

an ultrasound scanhead having a plurality of array transducer elements;

a transmitter coupled to the scanhead, the transmitter being operable to couple a first signal to a first plurality of the transducer array elements having an intensity that causes broad ultrasound waves to be generated by the array transducer elements with a sufficient amplitude to destroy microbubbles in tissues insonified by the ultrasound, the transmitter further being operable to couple a second signal to a group of transducer elements

having an intensity that causes focused ultrasound to be generated by the array transducer elements with an insufficient amplitude to destroy significant amounts of microbubbles in tissues insonified by the ultrasound;

an ultrasound receiver coupled to the scanhead, the receiver being operable to couple respective ultrasound reflection signals from the transducer elements in response to the second signal;

a processor coupled to the transmitter to cause the transmitter to couple the first signal to elements of the transducer array and then repetitively couple the second signal to the transducer elements, the processor further being coupled to the ultrasound receiver and being operable to process signals from the receiver generated responsive to the ultrasound reflection signals; and

a display device coupled to the processor for displaying ultrasound images generated from the processed signals from the receiver.

16. The ultrasound imaging system of claim 15 wherein the ultrasound scanhead comprises an ultrasound scanhead having a two-dimensional array of transducer elements.

17. The ultrasound imaging system of claim 15 wherein the ultrasound scanhead comprises an ultrasound scanhead having a phased array transducer.

18. The ultrasound imaging system of claim 15 wherein the first plurality of the transducer array elements comprises substantially all of the transducer array elements in the ultrasound scanhead.

19. The ultrasound imaging system of claim 15 wherein the ultrasound scanhead comprises an ultrasound scanhead generating a plane-wave ultrasound beam responsive to the first signal being applied to the first plurality of the transducer array elements.